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(19) (CA) **CANADIAN PATENT** (12)

(54) CONCRETE FORM SYSTEM

(72) Myhres, Tito F.E.,
Canada

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Canada

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ABSTRACT OF THE DISCLOSURE

This inv ntion is directed to a novel concrete forming system wherein the forms remain in place as part of the permanent concrete installation, and a method of making the forms. The concrete form unit useful for providing a a concrete form and remaining in place as part of the permanent in place concrete structure comprises:

(a) a four-sided planar form; (b) a plurality of interconnecting ribs spacially disposed on one side of the form; (c) a plurality of cross-ties perpendicularly protruding from the side of the form opposite the side having the ribs thereon, the cross-ties extending from locations on the sidewall opposite each point of intersection of the ribs on the opposite side of the sidewall; (d) the end regions of the ribs on at least one side of the form terminating short of the edge of the form on that side; (e) the end regions of the ribs on at least another side of the form extending slightly beyond the end regions of the form; and (f) a pluralty of holes penetrating through the width of the form spacially disposed around the circumference of the form.

Field of the Invention

This invention is directed to a novel concrete forming system wherein the forms remain in place as part of the permanent concrete installation.

Background of the Invention

Traditional methods of forming concrete structures involve the use of forms which are erected to provide moulds for the concrete. The concrete is poured in the cavities within the forms, and then after the concrete sets, the forms are removed to be dismantled or used again at another location. Often, the forms cannot be reused without being modified in certain respects. The concrete form technique is labour intensive. Further, any modifications increase the labour input required in order to re-use the forms. Technically, any forms which can be re-used should reduce the cost of construction, but because substantial erection and dismantling time is required there is always a substantial amount of labour input.

Years ago, particularly in North America, labour was relatively cheap and material costs represented the major cost in the construction industry.

In recent times, labour costs have soared. Not only has this raised the costs involved in erecting new buildings, structures and the like, but the ratio of labour to materials costs has increased to the point

where labour costs now frequently represent the largest single cost factor in erecting a new structure. Future trends indicate that labour costs will increase further relative to material cost. It is apparent, therefore, that minimizing labour costs will help to hold overall construction costs within reasonable limits.

Numerous techniques and attempts have been made by the construction industry to hold construction costs to as low a level as possible, by devising construction techniques that minimize labour content. Prefabricated forms, pre-built components for buildings and other structures, assembly line building component production techniques, and other labour-saving techniques have been developed and used.

Summary of the Invention

The applicant's construction system involves the use of a novel concrete form system which is designed to remain in place as part of the permanent concrete formed system. This eliminates the need to use forms which must be removed after the poured concrete has set. Labour costs in removing any such form work are thereby eliminated. Furthermore, the applicant's form system involves minimum labour input erecting the form system. The forms are designed to minimize the amount of labour required in order to assemble the forms in place. Following erection the concrete is poured within the cavities existing between the permanent form walls.

The form system is made of high grade materials thereby ensuring that the form work that remains in place is desirable, of high quality and capable of long coexistence within the concrete system. With the applicant's system it is not necessary, unless additional reinforcing is required, to incorporate steel reinforcing bars in the cavities that are filled with the poured concrete.

The invention is directed to a concrete form unit useful for providing a concrete form and remaining in place as part of the permanent in place concrete structure comprising:

(a) a four-sided planar form;

(b) a plurality of interconnecting ribs spacially disposed on one side of the form;

(c) a plurality of cross-ties perpendicularly protruding from the side of the form opposite the side having the ribs thereon, the cross-ties extending from locations on the sidewall opposite each point of intersection of the ribs on the opposite side of the sidewall;

(d) the end regions of the ribs on at least one side of the form terminating short of the edge of the form on that side;

(e) the end regions of the ribs on at least another side of the form extending slightly beyond the end regions of the form; and

(f) a plurality of holes penetrating through the width of the form, spacially disposed around the circumference of the form.

A unit according to the invention wherein the ribs on two sides of the form terminate short of the edges of the form on those two sides, and the ribs on the other two sides of the form, extend parallel with respect to those two sides of the form and one side of each thereof overlie the edges of those two sides of the form a distance commensurate with the distance that the ends of the ribs on the other two sides of the form fall short of the edges of the form on those two sides.

A unit according to the invention wherein the form is mortar which has expanded metal imbedded therein throughout its planar area.

A unit according to the invention wherein an end of each metal cross-tie is imbedded in the mortar of the form, extends through the expanded metal, and has at the embedded end of the cross-tie a circular disc-type head, the disc having disposed therethrough a plurality of holes.

A unit according to the invention wherein the disc-type head of the cross-tie has therein a conically shaped depression, the peak of which terminates within the head, and the base of which is co-terminus with the disc-type head of the cross-tie.

A concrete form system unit comprising two parallel disposed units according to the invention, each being disposed according to the reverse of the other so that the cross-ties protruding from each unit protrude toward and adjoin one another.

A unit according to the invention wherein the ends of the cross-ties adjoining one another are bolted together.

A unit according to the invention wherein the ends of the cross-ties adjoining one another are welded together.

A plurality of units according to the invention arranged in end to end courses with one another, the ribs and walls of one unit forming lap joints which meet with corresponding lap joints formed by the ribs and walls of an adjacent unit, succeeding courses of units being arranged in vertical relationship with the underlying courses of units, the top edges of the lower units meeting with the bottom edges of the overlying units to form lap joints with one another, each unit being adjoined to adjacent units by rods, galvanized nails, or galvanized tie wires that extend through holes located in the joint areas of each unit, thereby interlocking the adjacent units together.

A method of forming a planar form useful in erecting a permanent in-place concrete structure, comprising:

(a) providing a planar horizontal rectangular table-like surface, having a plurality of parallel, intersecting, grid-like grooves therein, arranged spacially in longitudinal and lateral relationship with one another, parallel with the sides and end edges of the table-like surface;

(b) arranging a plurality of linear cross-ties in perpendicular orientation to the plane of the table, the end of each cross-tie resting on a point of intersection of two of the grooves in the table-like surface;

(c) pouring and spreading a layer of pre-set mortar over the table-like surface so as to submerge the ends of the plurality of the cross-ties extending perpendicularly from the surface of the table;

(d) spreading a layer of expanded metal reinforcing mesh over the layer of mortar; and,

(e) pouring and spreading a second layer of pre-set mortar over the reinforcing mesh so as to completely cover the layer of mesh so that the plurality of cross-ties extend perpendicularly and spacially from one another from the second layer of mortar.

The method of the invention wherein the ends of the cross-ties imbedded in the first layer of mortar have flat disc-like heads, the disc-like heads having holes spacially oriented around and penetrating through the disc-like flat heads.

A method of the invention wherein the disc-like heads of the cross-ties rest upon small supports located spacially on the table, the supports holding the heads of the cross-ties a pre-determined distance above the respective bases of the groves formed in the table-like surface.

The method of the invention wherein the supports are conical in shape, and the ends of the cross-tie heads have therein corresponding conically shaped depressions which are sized to be received upon the conically shaped supports on the table-like surface.

The method of the invention wherein the supports are magnetized.

Drawings

The drawings identified as follows illustrate two embodiments of the applicant's concrete form structure.

Figure 1 represents a perspective view of two formed sidewalls held in place relative to one another with cross ties;

Figure 2 represents a front elevation view of a sidewall;

Figure 3 represents a section view taken along section A-A of Figure 2;

Figure 4 represents a section view taken along section B-B of Figure 2;

Figure 5 represents a detailed partial section elevation view showing first and second walls held in place relative to one another by a bolted steel cross-tie;

Figure 6 represents a top elevation view of a corner construction for the form system;

Figure 7 represents an end elevation view of a tie head with vent holes;

Figure 8 represents a partial section side elevation view of an alternative form of cross-tie having a conical hole punched in the head thereof, the hole in the head of the tie resting on a conical tie head support;

Figure 9 represents a perspective view of a portion of an assembled corner wall unit;

Figure 10 represents an alternative design of concrete form system unit;

Figure 11 represents a section view taken along section line C-C of Figure 10;

Figure 12 represents a top elevation view of a rectangular wall formed by units;

Figure 13 represents a perspective view of a rectangular wall supported upright by braces;

Figure 14 represents a perspective view of a circular wall system; and

Figure 15 represents a plan elevation view of curved interior and exterior units used to form a curved or circular wall.

Detailed Description of an Embodiment of the Invention

Referring to Figure 1, which illustrates in perspective form the basic concrete form unit 1, it can be seen that the basic form system consists of a pair of walls comprising a first rectangular sidewall 2 and a parallel disposed second rectangular sidewall 3. Each wall has a grid work of reinforcing ribs 4 on the side thereof oriented in a square pattern. The two walls 2 and 3 are held together and in spaced relation to one another by a plurality of spacially disposed cross-ties 5. The ribs 4 are raised in relation to the basic planar surface of the sidewall 2. A series of holes 6 are located around the periphery of the sidewall 2, usually at locations where the ribs intersect with one another, or on the periphery of the sidewall 2. These holes 6 are preformed in the sidewall 2 and can receive nails, preferably galvanized nails, or other fastening means, to secure the basic concrete unit system 1 to a similar concrete unit system is juxta-positioned either vertically above or below the concrete

form unit 1, or in end to end relationship with the concrete unit system 1. The ribs 4 are constructed so that on two sides of the rectangular sidewall 2, the ends of the ribs 4 terminate before they reach the edges of those two sides of the sidewall 2. On the opposite two sides of the sidewall 2, the ribs extend slightly beyond the edges of the sidewall 2 at those two locations, thereby providing an overhang on those two sides of the sidewalls 2. This construction design provides a set of interlocking lap joints 7 on each of the four sides of the rectangular sidewall 2. Thus, when concrete form unit 1 is used in combination with similar concrete form units, the lap joint 7 construction ensures that each concrete form unit 1 interlocks with the adjacent form unit. This enables a sturdy, stable interconnecting structure to be erected by laying the units in end-to-end relationship in a series of super-imposed courses. The joints 7 between the various concrete form units 1 formed by the lap joint system, can be linked further by the use of corrosion-proof nails which can be placed in the plurality of holes 6 located around the circumference of each form unit 1. The holes 6 are carefully positioned in design so that they meet with the holes 6 of adjoining form system units.

The concrete form system unit 1, illustrated in Figure 1, either in the plant or on the construction site, is assembled by bolting or welding together the plurality of cross-ties 5 which have been preformed in the first

sidewall 2 and second sidewall 3, according to techniques which will be discussed below.

Figure 2 illustrates a front view of a typical sidewall 2. In this Figure, the sidewall 2 is shown as having a length four times longer than its width. However, these dimensions are not fixed and can be altered as required. For example, the sidewalls 2 can be formed to be eight times longer in length than width. Indeed, the sidewall 2 can be only two times longer than its width, or even square. The sidewall 2 is shown as having eight laterally extending vertical ribs 4, and two longitudinally extending horizontal ribs 4. The ribs 4 add strength to the basic sidewall 2. This reduces distortion or bending of the sidewall 2 when lateral pressure is applied to the sidewall 2, such as when concrete is poured against one side thereof. The considerable hydrostatic pressure of the concrete provides a lateral force against the sidewall 2, thereby tending to deform the sidewall 2 out of its unstressed position. In Figure 2, sidewall 2 as demonstrated has holes 6 located around the periphery thereof at locations where the ribs 4 intersect around the circumference of the sidewall 2. The sidewall 2 is preferebly constructed according to a rectangular shape, because this promotes easy interlocking of a plurality of sidewalls 2 with on another.

Figure 3 illustrates a section view taken along section A-A of Figure 2. The basic wall 2 is

formed of construction mortar, which typically can be made of 2 1/2 parts sand, 1 part Portland cement, set time accelerators and water. A strengthner can be added to this, and other additives that tailor the performance and set time of the mortar to the specific requirements of the construction job. The sidewall 2 is formed so that it has ribs 4 on one side thereof and a plurality of cross-ties 5 protruding from the planar side of the wall 2, opposite the side formed with the ribs 4. The plurality of cross-ties 5 have on one end thereof tie heads 8, which are imbedded in the ribs 4 of the wall 2. An intermediate sandwiched layer of expanded metal 9 is provided within the wall to add strength to the basic sidewall 2 and to interlock the cross-ties 5 together.

Figure 4 illustrates a section view taken along section B-B of Figure 2. It can be seen that the construction of the sidewall 2 in the longitudinal direction is similar to the construction of the sidewall 2 in a lateral direction as demonstrated in Figure 3. The expanded metal core 9 at the edges of the sidewall 2 (at the lower end as illustrated in figure 3, or as at the right end as illustrated in Figure 4) is bent through a jog to accomodate the lap joint 7 (as seen in Figure 4) or lap joint 7a (as seen in Figure 3). These lap joints 7, and 7a are dimensioned to fit closely and snuggly relative to one another so that a basically wet concrete tight joint can be made between the respective sidewall units when they are fitted together.

Referring to Figure 5, which represents a partial section view of a first sidewall 2 positioned in

parallel with a second sidewall 3, it can be seen that the imbedded tie heads 8, in each of the two parallel opposite disposed sidewalls 2 and 3, secure respective end the of cross-ties 5 so that they extend towards one another. At the end of each cross-tie 5 is located a cross-tie joint area 10, which is a flattened area formed to fit and cooperate with a corresponding area 10 of another cross-tie 5. The two overlapping areas 10 are secured together by a pair of stove bolts 11. Unthreaded holes receiving the respective stove bolts 11 are formed in the respective cross-tie joint areas 10 of the respective cross-ties 5. It will be recognized that stove bolts 11 are one form of connecting together the respective cross-ties 5. However, other suitable fastening systems can be used, such as spot welds at each of the adjoining areas of the respective cross-ties 5, or even tie wire.

Figure 6 illustrates a corner construction for the basic concrete form unit system. The inside corner of the system is formed by an inside corner form 13. A corresponding outside corner form is illustrated as outside corner form 14. The inside corner form 13 is placed relative to the outside corner form 14 so that the two can be secured together at their respective end regions by laterally extending cross-ties 5, cross-tie joint areas 10, and interconnecting stove bolts 11, as described previously. A diagonally extending corner cross-tie 15 links the respective corners of the inside corner form 13 and the outside corner form 14 together. The diagonally extending corner cross-tie 15, replacing

the hypotenuse of a right angle triangle, is longer than the respective laterally exending cross-ties 5. However, except for the length difference, the cross-tie 15 is similar to cross-tie 5 and is connected together by cross-tie joint areas 10 and stove bolts 11. Of course, if another method of securement such as welding is used, then bolts 11 are not necessary. The inside corner form 13 and outside corner form 14 are formed to include lap joints 7 thereby permitting the corner forms to meet and interlock with the respective first sidewall 2, and second sidewall 3 of the adjacent concrete form unit 1 forming the first unit of the linear wall. Construction reinforcement holes 17 are located in a lap joint area 7 to reinforce the interlocking of the system with the basic wall unit 1 by means of nails, rods, or the like.

An end view of a cross-tie head 8 is illustrated in Figure 7. The tie-head 8 is formed of a steel disc which is welded or stamped to join solidly with the end of cross-tie 5. The tie head 8 is formed to have therein a plurality of tie head holes 12. These holes 12 act as air vent holes and prevent the formation of air pockets while the tie head 8 is being formed in place in the mortar used to form the sidewall 2.

An alternative form of cross-tie 20 is illustrated in Figure 8. This cross-tie 20 is formed so that is has a conically shaped impression 22 in the head thereof.

A basic sidewall 2 is formed on a flat metal table, such as a steel table, that has linear depressions for the ribs 4 formed in the surface of the table. When

forming a sidewall 2, a required number of cross-ties 5 complete with tie-heads 8 are located at the points of intersection of the depressions for the ribs 4 . The tie-heads 8 are placed on tie head supports 18 on the table (see Figure 5) so that the tie heads 8 are held above the table surface by a predetermined amount. This permits mortar to run under the tie-heads 8. Tie head supports 18 are located at each point on the table surface area where a tie head 8 is to be placed.

Once the required number of cross-ties 5 are placed in position so that their tie heads 8 are supported by the respective tie heads supports 18, the respective cross-ties 5 extend vertically in series from the horizontal table surface. Mortar is then poured over the table surface to a depth sufficient to submerge the tie heads 8 in the mould depressions for the ribs 4, and cover the planar areas of the table surface to a depth of about one-quarter of an inch. The holes 12 in the tie heads 8 ensure that no pockets of air are trapped between the tie head 8 and the table surface at the respective tie head 8 locations.

Once the initial layer of mortar has been poured, then a sheet of expanded metal core 9 is fitted over the vertically extending cross-ties 5 and spread over the entire surface area of the mortar. When the expanded metal core 9 is in place, a second pour of mortar is made over the expanded metal core 9 to a depth similar to the depth of pour of the first layer of mortar. By using this procedure, a sidewall 2 constructed of two outer layers of mortar with an intermediate

core of expanded metal 9 complete with ribs 4 on one side and perpendicularly extending cross-ties 5 on the other side is formed.

The cross-ties 5 can be of assorted lengths, as required, to accomodate various construction specifications. Furthermore, the cross-ties 5 can be made of metal sufficiently flexible that they can be bent downwardly to be more or less parallel with the sidewall 2, thereby enabling the sidewalls 2 to be stacked relative to one another for storage and shipment. When on the construction site, the cross ties 5 can be bent perpendicular so that they extend vertically relative to the sidewalls 2. They then can be joined to opposite cross-ties 5 can then be joined to opposite extending cross-ties 5 of an adjacent parallel sidewall 3, as illustrated in Figure 1, to form a basic unit 1.

At the construction site, as a first step in constructing a wall of building on the ground, it is customary to pour a concrete footing. This footing supports an assembled unit as illustrated in Figure 1, comprising a first sidewall 2, a second sidewall 3, and interconnecting cross-ties 5. The Unit can be set on the poured concrete footing while it is still in a semi-fluid state and levelled as required before the footing sets to hardness. A plurality of units 1, laid end to end, can be positioned around the circumference of the footing and appropriately levelled to form a first course of units 1. Once the concrete in the footing has set, second, third and subsequent courses of units 1 can be assembled end to end and linked together, to form a

complete integrated structure, similar to a conventional brick or block wall. Once the courses of units 1 have been put in place, concrete is poured within the cavity formed between the first sidewalls 2 and the second sidewalls 3 of the integrated units 1. If preferred, concrete can be poured after each course of units has been laid. A solid, stable concrete wall, with permanent stay-in place for units 1 can be readily erected if additional reinformcement is required, steel re-bars can be laid along one or more of the cross-ties before the concrete is poured.

Figure 8 illustrates an alternative form of cross-tie head 20. The cross-tie head 20 is formed so that it has a conical depression 22 stamped or formed in the side opposite the tie head that extends vertically from the sidewall 2. As the tie head 20 is being submerged in place with mortar 21, it rests on a tie head support 19, which is also conical in shape. The conical tie head support 19 fits within conical hole 22 of the tie head, thereby ensuring that the tie head 20 remains fixed in position and does not move during the pour of concrete. If desired, tie head support 19 can be magnetized to assist holding the conical hole 22 on tie head support 19. Once the tie head 20 is in place on the support 10, mortar 21 is poured in the rib cavity area of the sidewall, in a manner similar to that described previously. It may be desirable to have other shapes of depressions in the tie heads to suit other mold configurations used to form wall 2.

Figure 9 illustrates a perspective view of a

portion of an assembled corner wall unit resting on a footing 23. The footing is concrete poured within a footing forming unit 24. As shown in Figure 9, the unit is elongated and comprises 8 units in a series. The plurality of footing forming units 24 are arranged in series in parallel end-to-end relationship and tied together (not visible) before concrete is poured in the space defined by the units 24.

Figure 10 illustrates an alternative design of concrete form system unit 25 with pairs of vent holes 26, resting on a footing 23 made by using footing from units 24.

As illustrated in Figure 11, the concrete forming the main part of the footing 23 is poured in place after the confining units 24 are tied together by welded or stove bolted ties 27. The units 25 are then erected on the concrete in the footing 23 while the concrete is still not completely set. Figure 11 shows how the top ties of the bottom units can be wired to the bottom ties of the superimposed second course of units by tie wire 28 for increased stability.

Figure 12 represents a top elevation view illustrating how a course of tied units 1 are connected together to form walls and corners. The walls are formed of pairs of parallel disposed standard units 1 connected in end to end relations by tie wires 29. The wall units having lap joints all oriented in the same manner must have at some place along the length of a wall a special forming unit 30 which has an indented lap joint 31 at each end. The forming unit 30 is thus able to receive

snugly extended laps of adjacent units at each end. If the unit 30 were not provided, two extended laps would meet at some point along the length of the wall th reby preventing a snug secure fit. Figure 12 also illustrates the construction of the inside and outside corner forms 13 and 14.

Figure 13 demonstrates how the top of a rectangular wall can be supported by a 2 x 4 whaler 31 around the exterior circumference of the wall. The whaler 31 is propped up around the periphery with braces 32.

An alternative form of unit 33, useful for forming circular wall enclosures, is illusterated in Figures 14 and 15. The units 33 are cast to conform with the circumference of a circle. The interior units 34 necessarily are cast to have a shorter radius of curvature than the exernal units 33. Circular footings 35 are poured with circular footing forming units 36.

As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the spirit or scope thereof. Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.

THE EMBODIMENTS IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE SET FORTH IN THE FOLLOWING CLAIMS:

1. A concrete form unit useful for providing a concrete form and remaining in place as part of the permanent in place concrete structure comprising:

(a) a four-sided planar form;

(b) a plurality of interconnecting ribs spacially disposed on one side of the form;

(c) a plurality of cross-ties perpendicularly protruding from the side of the form opposite the side having the ribs thereon, the cross-ties extending from locations on the sidewall opposite each point of intersection of the ribs on the opposite side of the sidewall;

(d) the end regions of the ribs on at least one side of the form terminating short of the edge of the form on that side; (e) the end regions of the ribs on at least another side of the form extending slightly beyond the end regions of the form; and (f) a plurality of holes penetrating through the width of the form, spacially disposed around the circumference of the form.

2. A unit as defined in claim 1 wherein the ribs on two sides of the form terminate short of the edges of the form on those two sides, and the ribs on the other two sides of the form, extend parallel with respect to those two sides of the form and one side of each thereof overlie the edges of those two sides of the form a

distance commensurate with the distance that the ends of the ribs on the other two sides of the form fall short of the edges of the form on those two sides.

3. A unit as defined in claim 2 wherein the form is mortar which has expanded metal imbedded therein throughout its planar area.

4. A unit as defined in claim 3 wherein an end of each metal cross-tie is imbedded in the mortar of the form, extends through the expanded metal, and has at the embedded end of the cross-tie a circular disc-type head, the disc having disposed therethrough a plurality of holes.

5. A unit as defined in claim 4 wherein the disc-type head of the cross-tie has therein a conically shaped depression, the peak of which terminates within the head, and the base of which is co-terminus with the disc-type head of the cross-tie.

6. A concrete form system unit comprising two parallel disposed units as defined in claim 1, each being disposed according to the reverse of the other so that the cross-ties protruding from each unit protrude toward and adjoin one another.

7. A unit as defined in claim 6 wherein the ends of the cross-ties adjoining one another are bolted together.

8. A unit as defined in claim 6 wherein the ends of the cross-ties adjoining one another are welded together.

9. A plurality of units as defined in claim 6, arranged in end to end courses with one another, the ribs and walls of one unit forming lap joints which meet with

corresponding lap joints formed by the ribs and walls of an adjacent unit, succeeding courses of units being arranged in vertical relationship with the underlying courses of units, the top edges of the lower units meeting with the bottom edges of the overlying units to form lap joints with one another, each unit being adjoined to adjacent units by rods that extend through holes located in the joint areas of each unit, thereby interlocking the adjacent units together.

10. A method of forming a planar form useful in erecting a permanent in-place concrete structure, comprising:

(a) providing a planar horizontal rectangular table-like surface, having a plurality of parallel, intersecting, grid-like grooves therein, arranged spacially in longitudinal and lateral relationship with one another, parallel with the sides and end edges of the table-like surface;

(b) arranging a plurality of linear cross-ties in perpendicular orientation to the plane of the table, the end of each cross-tie resting on a point of intersection of two of the grooves in the table-like surface;

(c) pouring and spreading a layer of pre-set mortar over the table-like surface so as to submerge the ends of the plurality of the cross-ties extending perpendicularly from the surface of the table;

(d) spreading a layer of expanded metal reinforcing mesh over the layer of mortar; and,

(e) pouring and spreading a second layer of pre-set mortar over the reinforcing mesh so as to completely cover the layer of mesh so that the plurality of cross-ties extend perpendicularly and spacially from one another from the second layer of mortar.

11. The method of claim 10 wherein the ends of the cross-ties imbedded in the first layer of mortar have flat disc-like heads, the disc-like heads having holes spacially oriented around and penetrating through the disc-like flat heads.

12. A method of claim 11 wherein the disc-like heads of the cross-ties rest upon small supports located spacially on the table, the supports holding the heads of the cross-ties a pre-determined distance above the respective bases of the groves formed in the table-like surface.

13. The method of claim 12 wherein the supports are conical in shape, and the ends of the cross-tie heads have therein corresponding conically shaped depressions which are sized to be received upon the conically shaped supports on the table-like surface.

14. The method of claim 13 wherein the supports are magnetized.

Barrigar & Oyen
Barristers & Solicitors
Patent and Trade Mark Agents
Ste. 280, 505 Burrard Street
Vancouver, B. C.

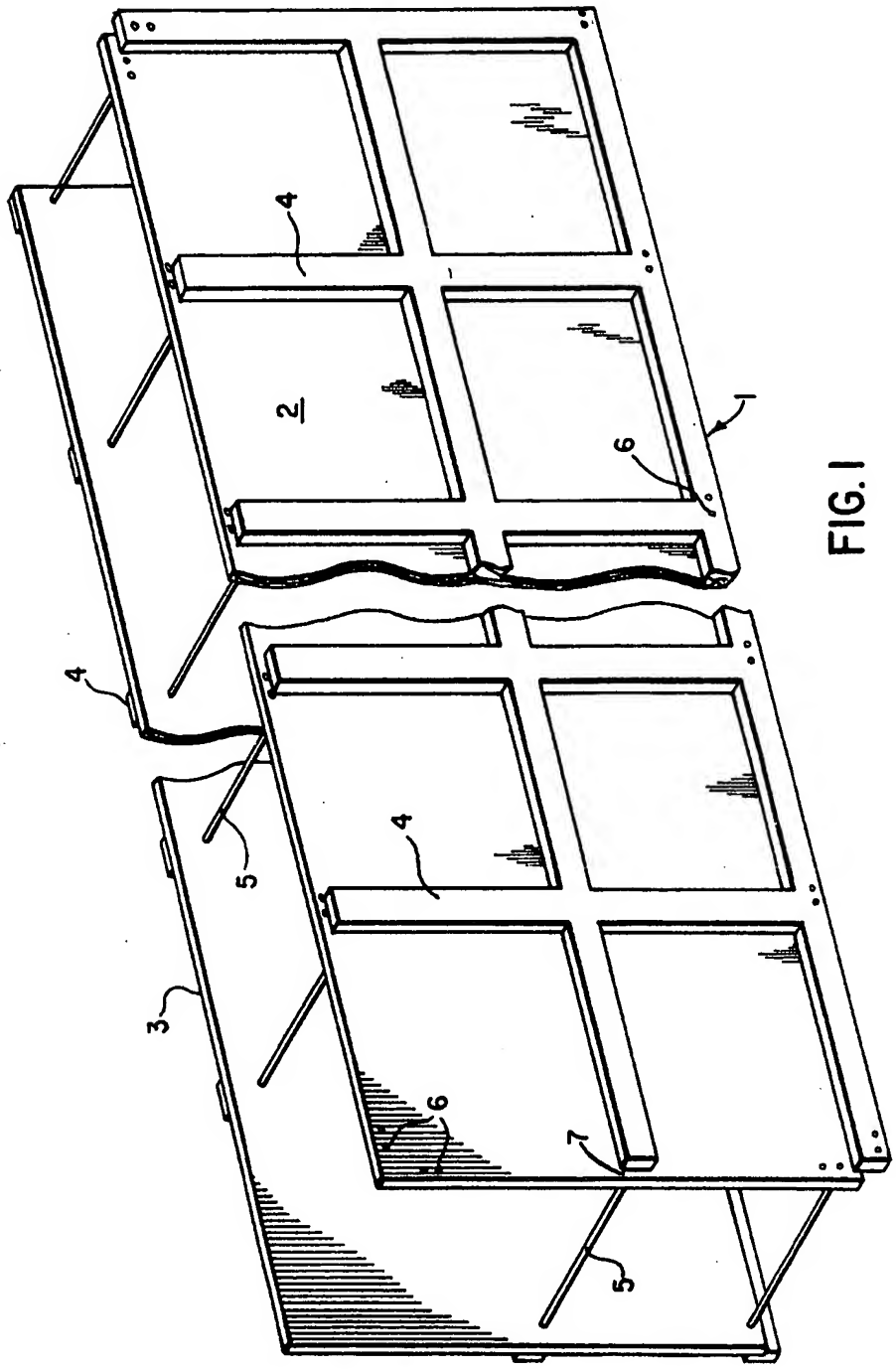

FIG. 1

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BARRIGAR & OYEN
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the Applicant.

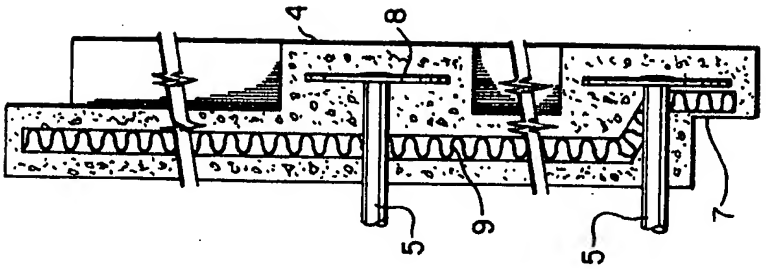

FIG. 3

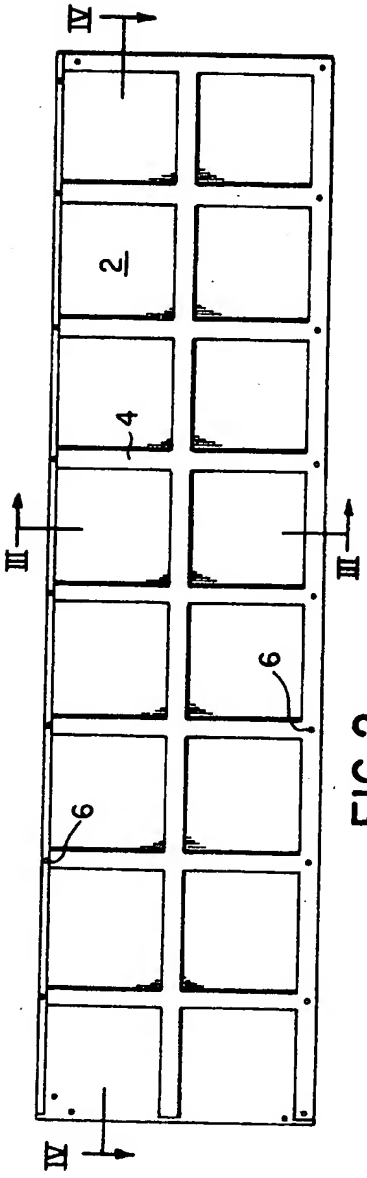

FIG. 2

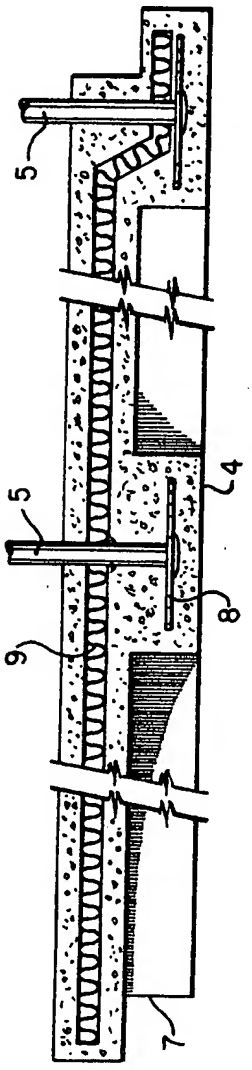

FIG. 4

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BARRIGAR & OYEN
Patent Agents for
the Applicant.

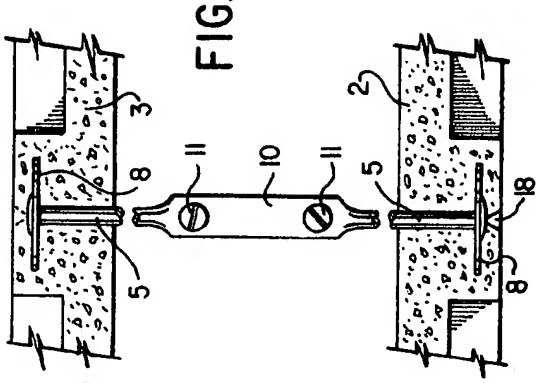

FIG. 5

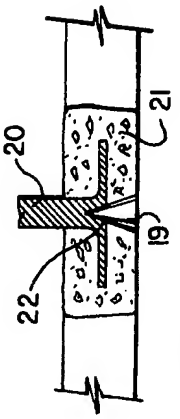

FIG. 8

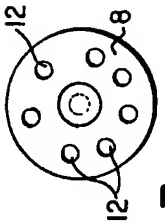

FIG. 7

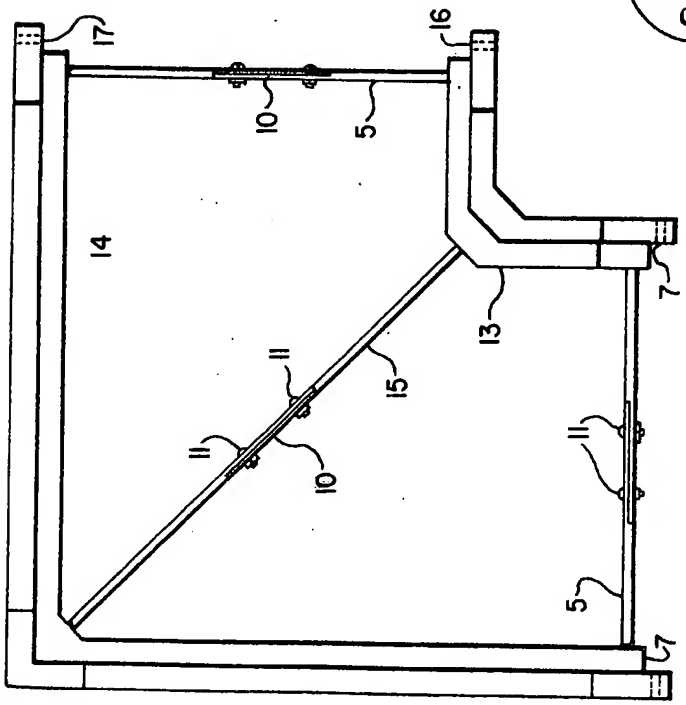

FIG. 6

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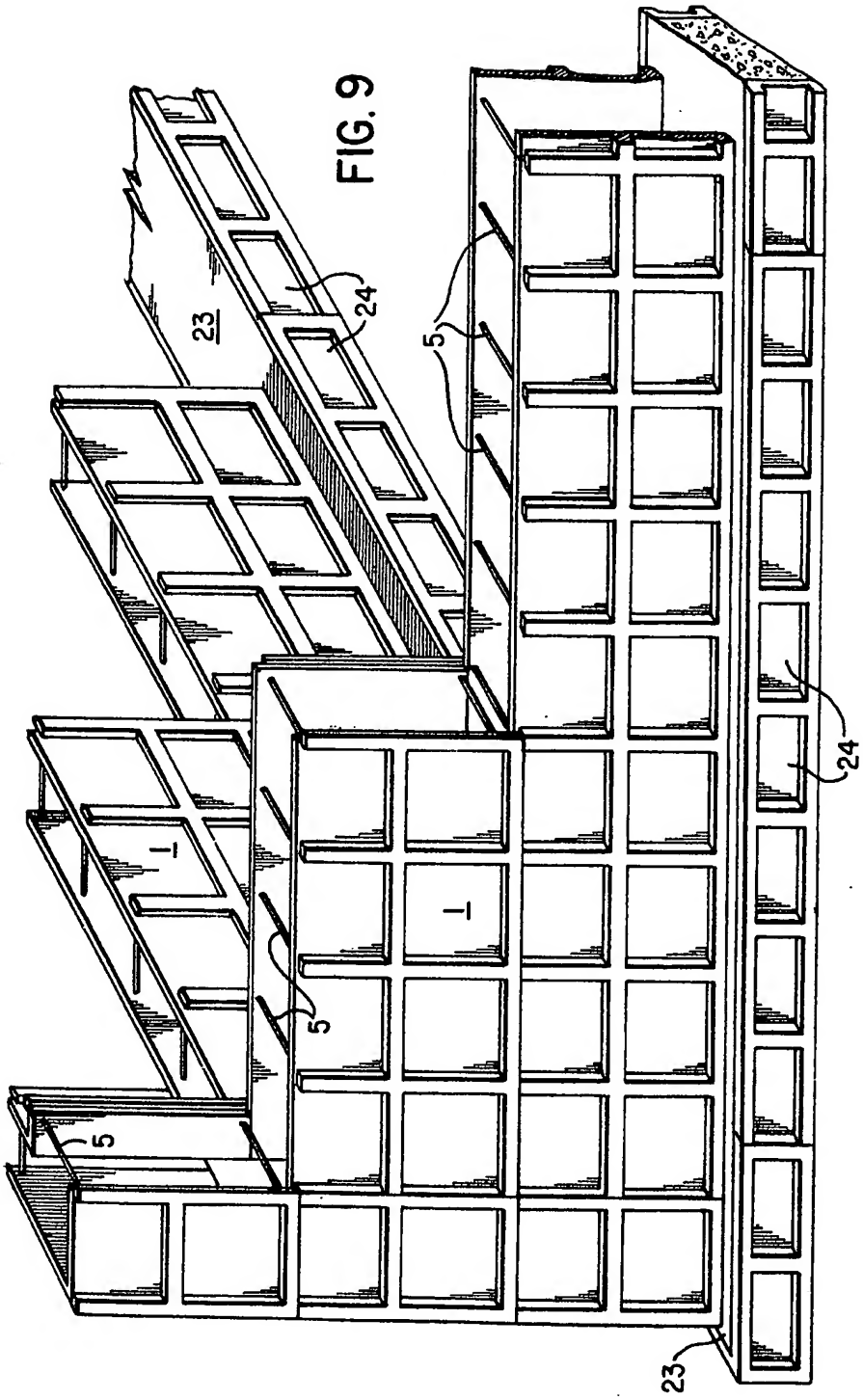
FIG. 9



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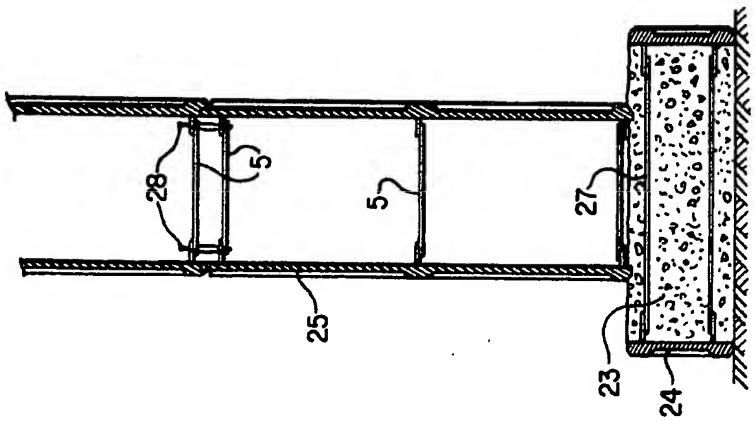

FIG. 11

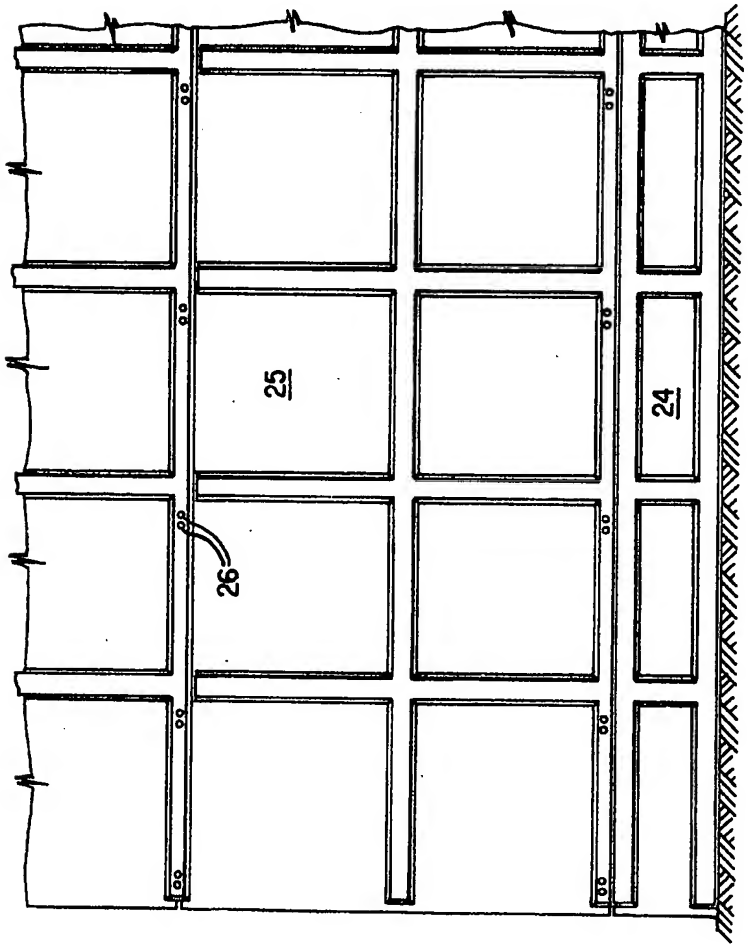

FIG. 10

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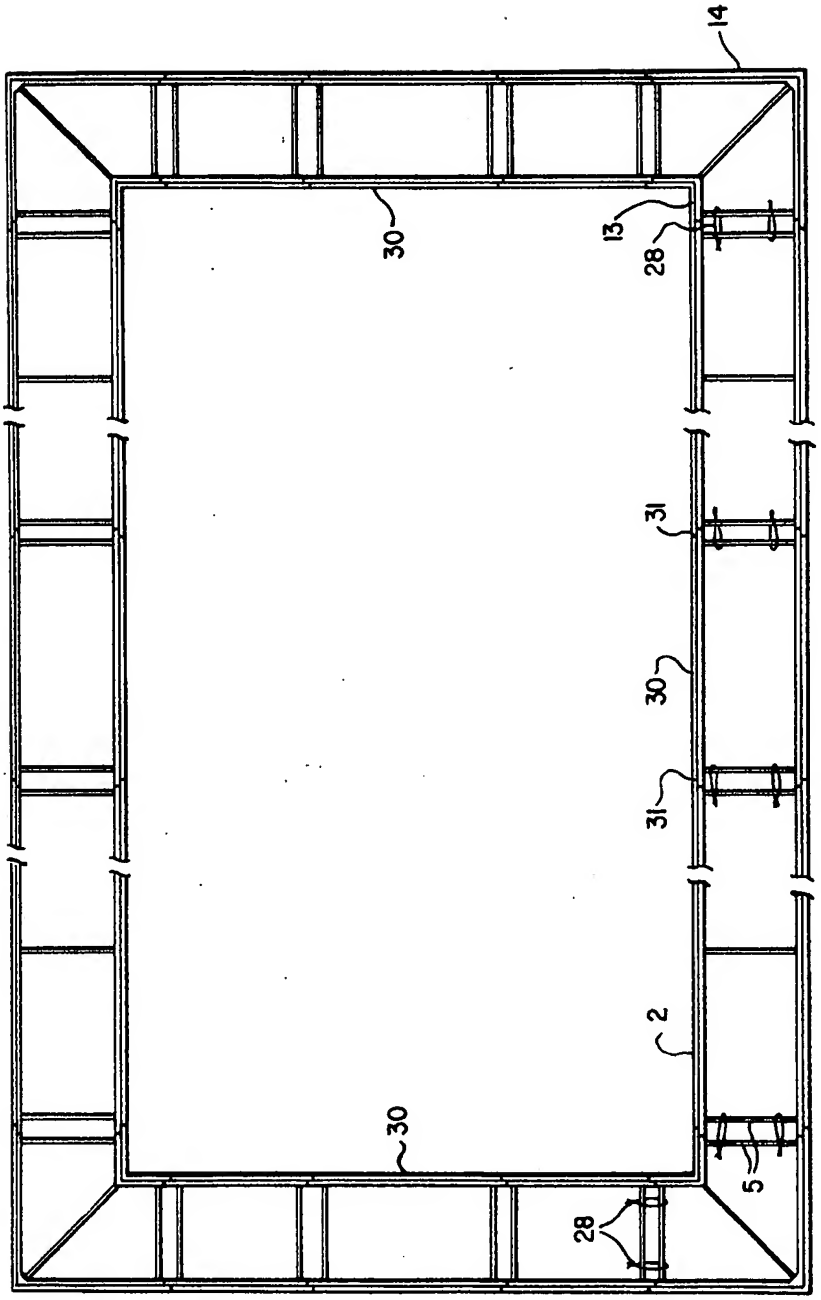

FIG. 12

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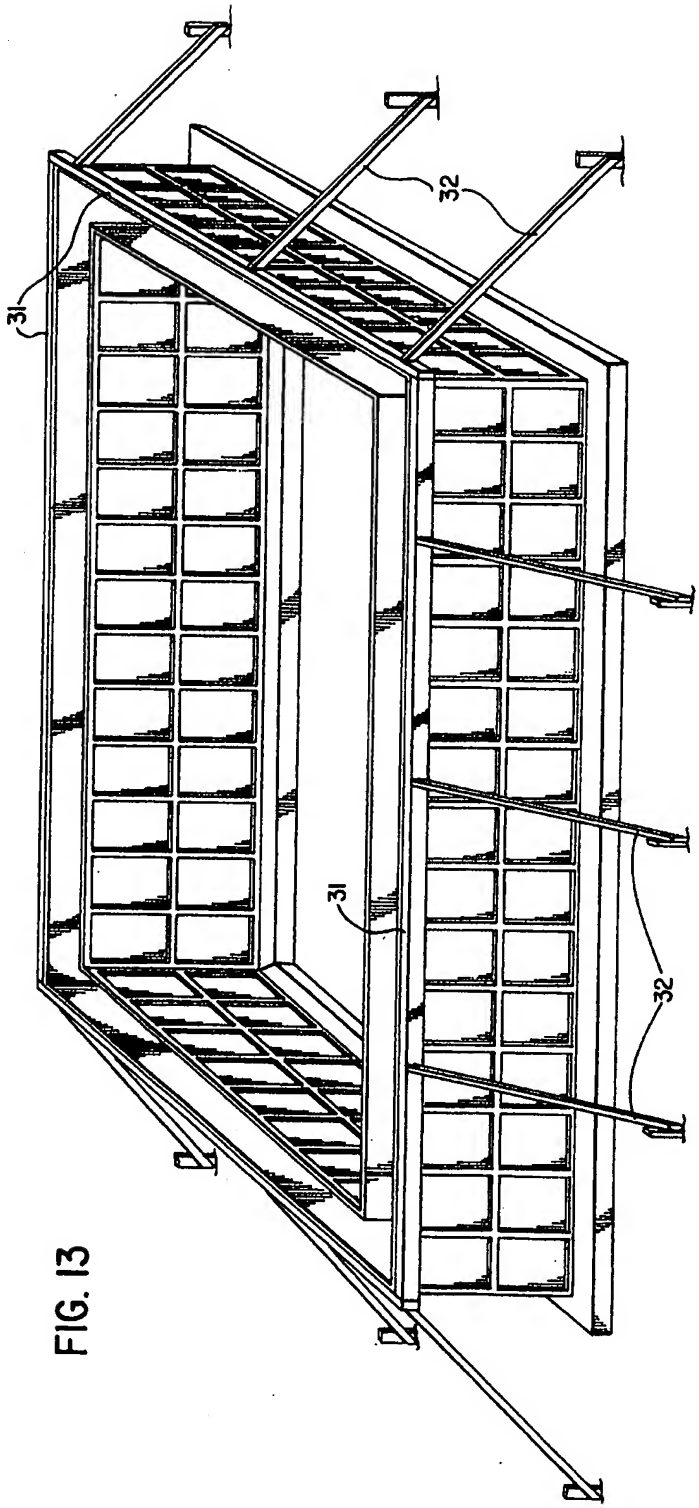

FIG. 13

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FIG. 15

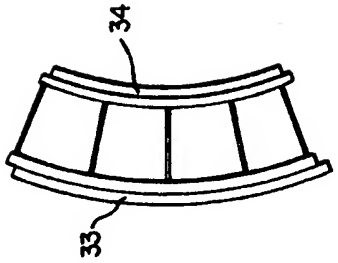
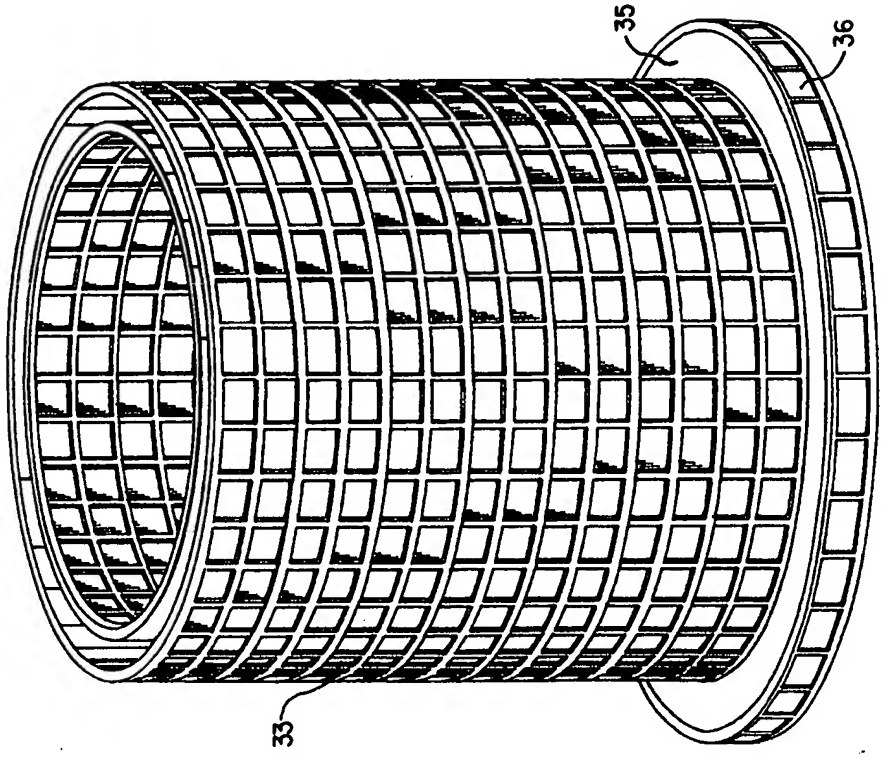


FIG. 14



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